Complete Summary

GUIDELINE TITLE

Apnea of prematurity.

BIBLIOGRAPHIC SOURCE(S)

National Association of Neonatal Nurses. Apnea of prematurity. Glenview (IL): National Association of Neonatal Nurses; 1999. 22 p. [43 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Apnea of prematurity (AOP)

GUIDELINE CATEGORY

Management

CLINICAL SPECIALTY

Nursing
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Nurses

GUIDELINE OBJECTIVE(S)

To provide the foundation for specific nursing protocols, policies, and procedures pertaining to apnea of prematurity that individual institutions may further develop.

TARGET POPULATION

Premature infants

INTERVENTIONS AND PRACTICES CONSIDERED

1. Vital sign assessment to establish infant's baseline heart rate and respiratory rate
2. Machine-assisted cardiorespiratory monitoring of infant with establishment of audible alarm limits
3. Infant positioning to assist ventilation
4. Visual observation of infant following apneic episode
5. Maintenance of a neutral thermal environment (NTE) for the infant with avoidance of stimuli that may trigger apnea or bradycardia (e.g. cold air)
6. Maintenance of resuscitative equipment at infant's bedside
7. Avoidance of vigorous manual ventilation
8. Assessment of need for manual stimulation
9. Suction as indicated by the infant's clinical status with use of appropriate respiratory support as needed
10. Kangaroo care (skin-to-skin contact)
11. Water bed and oscillating air mattresses
12. Pharmacologic treatment (e.g. methylxanthines)
13. Transfusion of blood products as indicated
14. Parent and caretaker education (e.g. CPR)
15. Assessment of infant's tolerance for car seat and need for home monitoring

MAJOR OUTCOMES CONSIDERED

Infant Outcomes:

- The infant will achieve/maintain adequate respiratory and cardiovascular status as evidenced by

    a. regular respiratory rate between 30 and 60 breaths per minute
    b. heart rate between 100 and 160 beats per minute (BPM) with normal sinus rhythm
    c. oxygen saturation between 92 and 100 percent
    d. absence of apneic episodes greater than 20 seconds in duration

- The infant will recover from apneic, bradycardic, or hypoxic events with minimal intervention.

Family and Caregiver Outcomes:

- The infant's family and other caregivers will demonstrate adequate caregiving activities as demonstrated by:

a. ability to explain the basic causes of apnea of prematurity (AOP)
b. demonstration of adequate response to monitor alarms and proper use of specifically indicated home monitor
c. appropriate assessment, intervention, or both, during apneic episodes
d. demonstration of infant CPR technique and obstructed airway management
e. knowing the name of indicated medication, its side effects, administration techniques, dosage and dosage schedule
f. use of appropriate positioning as it relates to AOP
g. proper utilization of emergency rescue services, including access to telephone

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The MEDLINE, Cochrane, and Vermont Oxford databases were searched by the guideline developer using the keywords apnea, premature, and neonate.

NUMBER OF SOURCE DOCUMENTS

Approximately 100

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Subjective Review

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The American Academy of Pediatrics volunteered to review the initial drafts of the document. In addition to the NANN Board of Directors who reviewed these guidelines prior to publication, other contributors and reviewers are recognized in the guideline document for their assistance.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Important Note: The nursing interventions discussed below are not listed in order of performance or importance. Some of these interventions may not be appropriate for all patients. The infant's response to the interventions must be assessed. The infant must undergo continued reevaluation at regular intervals as needed.

Suggested Interventions

1. Assess the infant's vital signs every two to four hours as determined by patient acuity and clinician's order.
2. Maintain the infant on a cardiorespiratory monitor with alarm limits set to audible activation as per unit policy. Alarm limits must be used as guidelines. Limits can be altered based on the infant's postconceptual age and baseline vital signs. Recommendations vary in different inpatient centers; however, a general guideline is to monitor all infants of less than 34 weeks gestation for at least the first week of life. Event recorders are used in some nursery settings. Event recorders are capable of recording bradycardic, apneic, and hypoxic events in the infant. Certain recorders can be downloaded to a computer and reviewed to determine whether the reading was caused by a loose lead or by shallow breathing rather than by a patient event.
3. Position the infant to assist ventilation. Place the infant's head and neck in the neutral "sniffing" position. The head of the bed should be elevated 15 to 30 degrees. Infants should be positioned in prone or lateral position if possible. Prone placement may provide increased oxygen tension, shorter gastric emptying time, and decreased incidence of regurgitation and subsequent aspiration. Lateral placement may prevent the tongue from occluding the airway. A neck roll can slightly extend the neck. This may prevent airway obstruction.

4. Observe the infant during and after an apneic episode. To observe color, adequate overhead lighting is required. Assess facial, perioral, and periorbital mucous membranes; and nail beds for color. Assess tone for limpness or flaccidity. Determine general body position (prone, supine, or lateral) and the presence or absence of neck flexion during episodes. Note the type and duration (in seconds) of alarms; oxygen saturation readings can also be recorded. Determine if there are accompanying events; note if the event is associated with sleeping, oral or tube feedings, vomiting, stooling, or other signs of overstimulation such as finger splays or hiccuping.
5. Maintain the infant in a neutral thermal environment (NTE). This will reduce oxygen consumption and will prevent apnea associated with a warm environment.
6. Maintain resuscitative equipment at the bedside. A manual resuscitation bag, a face mask of appropriate size, and suction equipment should be in working order. Oxygen and air mixture should be available.
7. Avoid vigorous manual ventilation. Inflating pressures as recommended by the Neonatal Resuscitation Program (NRP) are 15 to 20 cm H_2O for infants with compliant lungs and 20 to 40 cm H_2O for infants with decreased lung compliance.
8. Assess the need for manual stimulation. Cutaneous stimulation increases the number of external stimuli, which compensates for the decrease in afferent signals to the respiratory center. If the infant does not self-revive from an apneic episode, sensory stimulation such as rubbing the feet or turning the infant may be sufficient to interrupt it. Infants who do not respond to tactile stimulation may require resuscitation with bag and mask ventilation. Each infant's response to various stimuli, and the possible need for bag and mask ventilation, must be individually assessed. Do not attempt to stop the apneic episode by applying vigorous or noxious stimulation, such as loud noises, banging on the incubator, or excessive shaking. Intense stimulation may increase systemic blood pressure and intracranial pressure to the point of causing an intracranial hemorrhage.
9. Suction only as indicated by the infant's clinical status. Careful observation of infant responses throughout the suction protocol allows for early intervention to reduce dramatic physiologic changes and prevent iatrogenic harm.
10. Avoid triggering reflexes that may result in apnea or bradycardia. Cold air (possibly from oxygen sources) to the infant's face can affect the trigeminal nerve and cause an apneic event. Respiratory gases administered to the infant should be warmed and humidified for this reason. Sudden gastric distention may impede diaphragmatic excursion. Feeding route may trigger apnea, bradycardia, hypoxemia, or all three. Feeding via nasogastric or orogastric tube may be indicated for recurrent apnea and bradycardia. However, the use of the feeding tube may also be deleterious for the premature infant.
11. Provide individualized supportive care. Provision of care as outlined in the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) demonstrates a reduction in untoward outcomes for premature infants. NIDCAP and other developmental care approaches strive to provide individualized care that supports the neonate's behavioral competencies. A potential benefit of individualized care is the promotion of a deep-sleep state.
12. Sleep deprivation has been shown to impair chemoreceptor responses in animals and increase the frequency of short apneic episodes in term infants. Abrupt stimulation of an infant can provoke an apneic episode. Sleep can be promoted through developmental care. Use of containment, grasping

opportunities, nonnutritive sucking, and a proper developmental environment decreases the incidence of such responses. In addition, the use of kangaroo care (skin-to-skin contact) has been shown to assist infants with apnea of prematurity (AOP).

13. Water bed and oscillating air mattresses can be used in the treatment of AOP. The proposed mechanism of action is the effect on cutaneous and vestibuloproprioreceptive sensory inputs which stimulate breathing. Neurodevelopmental care with an emphasis on uninterrupted duration of sleep can further limit the appropriateness of this therapy.
14. Administer pharmacologic treatment as ordered. Pharmacologic interventions may be considered when an infant experiences at least 3 episodes of significant apnea within a 24 hour period that requires stimulation or bag-mask ventilation in order to resolve. Methylxanthines of choice are theophylline, aminophylline, and caffeine. These drugs act primarily on brain stem respiratory neurons, producing a central stimulatory effect and possible enhanced diaphragmatic contractility while decreasing diaphragmatic fatigue. Another respiratory stimulant, doxapram, is used with varying frequency in some centers. Special considerations concerning the use of theophylline, caffeine, and doxapram are as follows:

    Theophylline

    Closely monitor theophylline levels when administered with furosemide, rifampin, barbiturates, verapamil, beta blockers, allopurinol, and phenytoin, since increased hepatic clearance may result in decreased theophylline levels. Erythromycin and cimetidine administration may decrease theophylline clearance, resulting in toxic levels. Theophylline and caffeine can increase gastric acid secretion and decrease esophageal sphincter pressure. This can lead to gastroesophageal reflux and may lead to feeding intolerance.

    Caffeine

    Caffeine offers several advantages over theophylline. These advantages include a similar reduction in the frequency of apnea, an earlier increase of ventilatory rate, and a more rapid diffusion into the cerebrospinal fluid. Caffeine also produces less of an increase in heart rate than does theophylline. Caffeine plasma levels appear more stable than theophylline levels.

    Serum caffeine levels can be present for up to nine days following administration. Consider discontinuing medication one week prior to discharge so that the infant can be accurately assessed via pneumogram, clinical symptoms, or both.

    If the infant cannot be weaned from one of the medications prior to discharge, caffeine is more convenient than theophylline for parents to administer since it can be given by mouth once a day. However, compliance issues are a factor to be considered. Caffeine may be difficult to obtain in the outpatient setting. Caretakers may require assistance in locating a pharmacy that stocks caffeine. Caffeine can be safely and effectively administered at the same time as theophylline as long as there are therapeutic theophylline levels, but this needs further investigation.

Percutaneous caffeine at doses of 7.5 to 10 mg twice a day via the application of gel to the abdomen has been utilized. This method of administration is still under investigation.

Doxapram

Doxapram has a significant effect on the frequency of apneic episodes. Within six hours after stopping doxapram, the frequency of apneic events in a group of premature infants increases. Therefore, infants are treated with caffeine six hours after the last dose of doxapram. A major concern with the use of doxapram in the U.S. is that it is prepared in a vial containing benzyl alcohol. Benzyl alcohol toxicity in the neonate (at doses from 99 to 404 mg/kg/day) has been reported; death results from metabolic acidosis, central nervous depression, respiratory distress leading to gasping respirations, hypotension and renal failure. The recommended dose of doxapram delivers approximately 20 to 30 mg/kg/day of benzyl alcohol. Although this is less than the dose reported to be associated with toxicity, it nevertheless remains a concern.

Doxapram requires an intravenous infusion, which limits its use to the treatment of apnea refractory to methylxanthines. Further studies are required to better understand the effects of doxapram on apnea. There have been discussions about taking this medication off the market in the United States. For that reason and the lack of evidence to support its use in apnea, no suggested dosages or therapeutic ranges will be given in this document.

15. Transfuse blood products as indicated. Transfusion of packed red blood cells to correct anemia and to increase the oxygen-carrying capacity of the blood is a common treatment method. The transfusion is thought to decrease the potential for depression of the respiratory center that detects hypoxia. Further investigation regarding the use of blood transfusion is needed. Until more data are generated, the benefits of administering blood products must be balanced against the risks such as HIV or hepatitis B.
16. Use appropriate respiratory support. Hypoxemia associated with apnea and bradycardia may be treated with oxygen therapy. Nasal continuous positive airway pressure (NCPAP) can be used as a treatment for AOP. Nasal CPAP increases functional residual capacity, alters the influence of stretch receptors, and provides a splint for the upper airway. These factors help to stabilize arterial oxygenation and prevent airway obstruction. NCPAP is effective in treating mixed or obstructive apnea but has little effect on central apnea, since central apnea originates within the central nervous system (CNS). For severe, recurrent episodes of apnea that are refractive to pharmacologic treatment and CPAP administration, the use of mechanical ventilation may be necessary. This is especially indicated if there is significant inter-apnea hypoventilation (shallow breathing that occurs between apneic events) and respiratory acidosis. In these instances the history and physical exam must be carefully reviewed since it is likely that an underlying cause of the apnea can be determined.
17. Assess the infant's tolerance to car seat use. The use of car seats in premature infants has been shown to increase the incidence of apneic and hypoxic episodes. This is thought to be because positioning in the car seat increases neck flexion. The American Academy of Pediatrics recommends that premature infants be placed in the car seat intended for home transportation

and monitored with pulse oximetry and cardiorespiratory monitoring before discharge. Car beds can be obtained if the infant is unable to sustain adequate respirations and oxygenation in a car seat.

18. Include parents and significant caretakers in any discussion of the infant's apneic spells and response. Nurses can assure parents that in the majority of infants, these episodes resolve by 37 to 50 weeks postconceptual age. The caretakers need to know that the infant may require apnea monitoring with or without the use of medication in the home. Caretakers must be educated regarding the administration and side effects of medication, the use of apnea monitors, and infant CPR/obstructed airway management. Parents may be concerned about Sudden Infant Death Syndrome (SIDS).

    Resolution of recurrent apnea and bradycardia episodes and completion of an "apnea-free" period of 5 to 10 days are generally considered to be pre-conditions for discharge of a premature infant without a home cardiorespiratory monitor. Parents need to know how the determination will be made as to whether or not a home monitor will be necessary.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

The neonatal nurse must assist in the identification of infants with apnea of prematurity. The nurse must also help to provide intervention and evaluate treatment for these infants.

Effective nursing interventions will result in improved health outcomes for the infant (adequate respiratory and cardiovascular status) and demonstration of adequate caregiving activities by the infant's family and other caregivers.

POTENTIAL HARMS

Side effects associated with pharmacologic management:

Theophylline/aminophylline (IV). Tachycardia, cardiac dysrhythmias, seizures, jitteriness, dehydration, hyperglycemia, hypotension, increased cerebrovascular resistance, central nervous system irritability, sleeplessness, diuresis, feeding intolerance.

Caffeine citrate. Restlessness, vomiting and functional cardiac symptoms such as tachycardia, cardiac dysrhythmias, wakefulness, active sleep, gastrointestinal (GI) distention, GI bleeding, diuresis with sodium loss.

QUALIFYING STATEMENTS

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- This guideline does not preclude the use of other acceptable methods of caring for infants who experience apnea. Additional practices known to improve the quality of neonatal care are encouraged and not restricted despite the development of this document.
- Evaluation and management of premature infants who are medically ready for discharge despite apneic or bradycardic events remains controversial. Practice varies considerably among neonatal health professionals. Studies are needed to support evidence based practices for this population.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

National Association of Neonatal Nurses. Apnea of prematurity. Glenview (IL): National Association of Neonatal Nurses; 1999. 22 p. [43 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

National Association of Neonatal Nurses - Professional Association

SOURCE(S) OF FUNDING

National Association of Neonatal Nurses (NANN)

GUIDELINE COMMITTEE

Education and Practice Committee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Christine Embon and Judith A. Humphrey

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Not available at this time.

Print copies: Available from the National Association of Neonatal Nurses (NANN), 4700 W. Lake Avenue, Glenview, IL 60025-1485. An order form is available at the NANN Web site.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on February 28, 2000, 1999. The information was verified by the guideline developer on March 10, 2000.

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